A New Tooth

(just what dentist ordered?)

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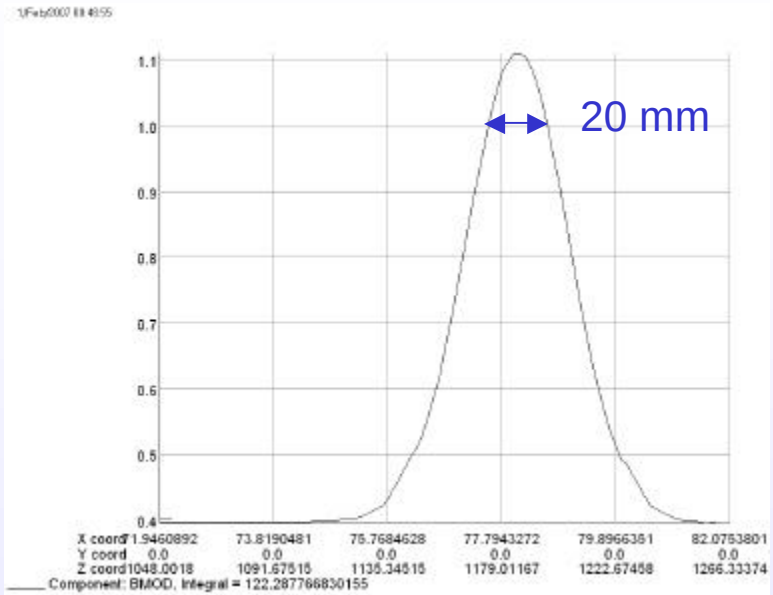
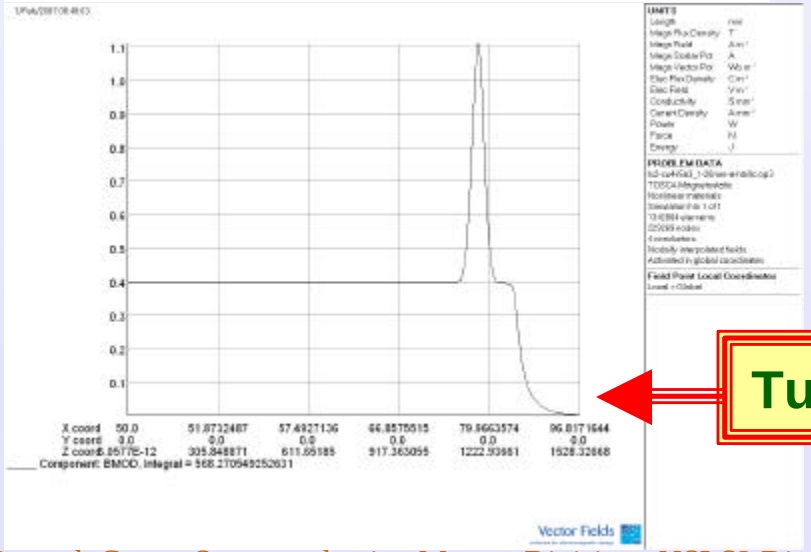
Does this Tooth Satisfy Functional Requirements?

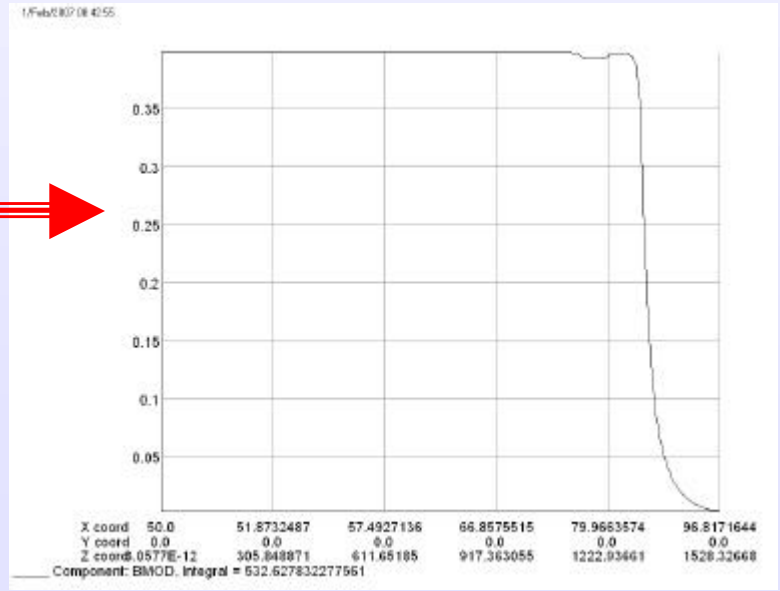


- 20 mm Pole
- 1.1+ T Peak Field
- 1T+ field in ~20 mm region
- Easy adjustment in of peak field (or deflection) during operation
- No dip in field at the shoulders of the tooth (good field quality)
- Turn-off the tooth electrically

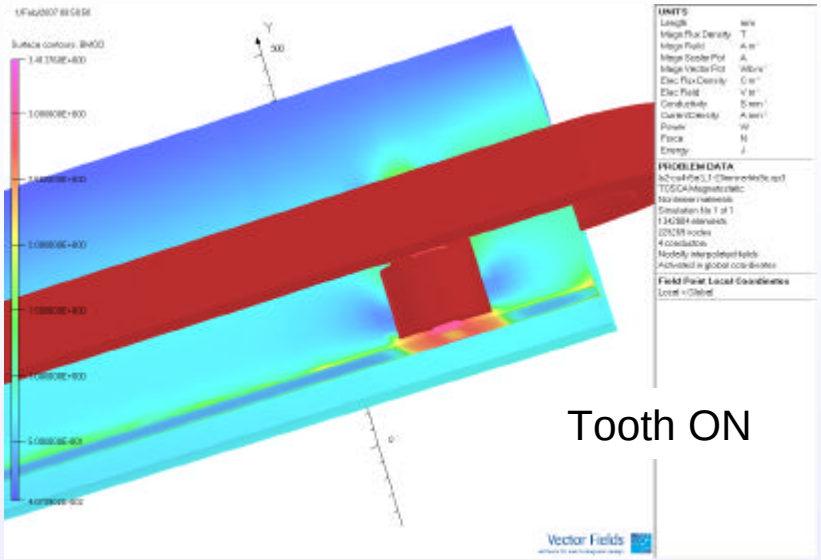


Turn OFF

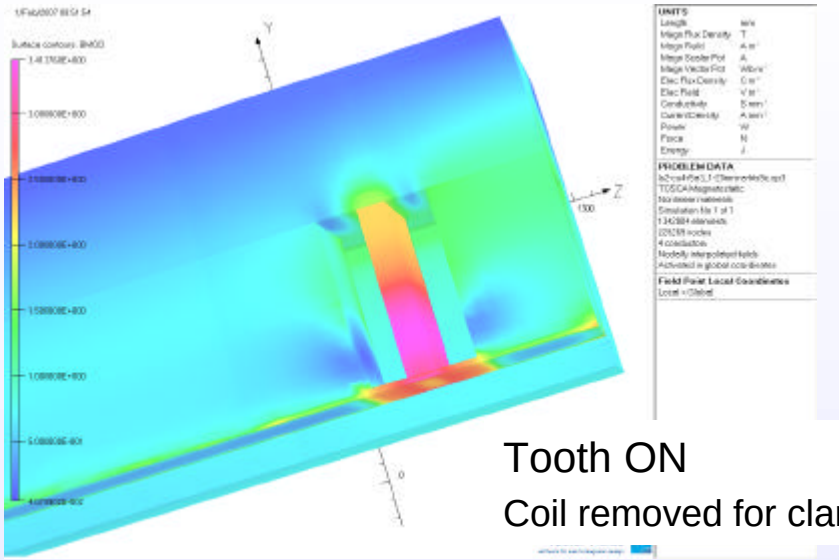
Turn ON



New Design of Electromagnetic Tooth (HTS tooth with WEB)

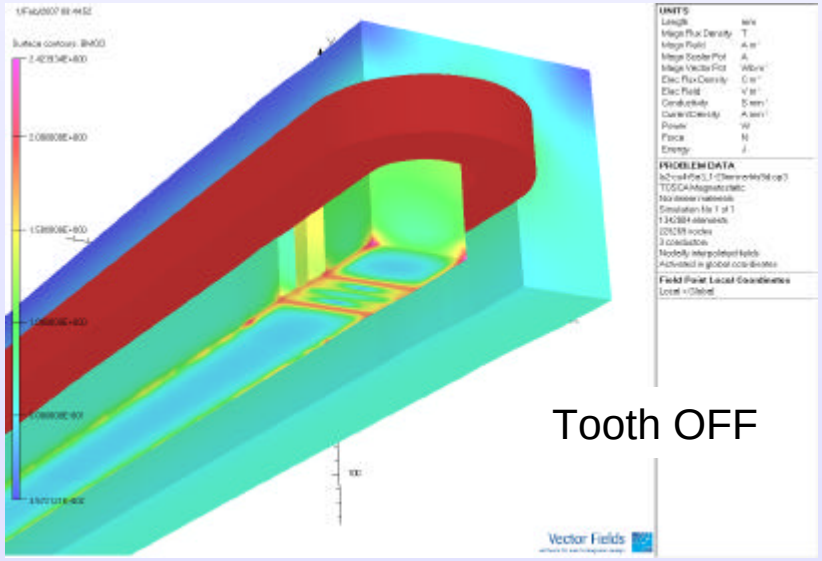


Tooth ON

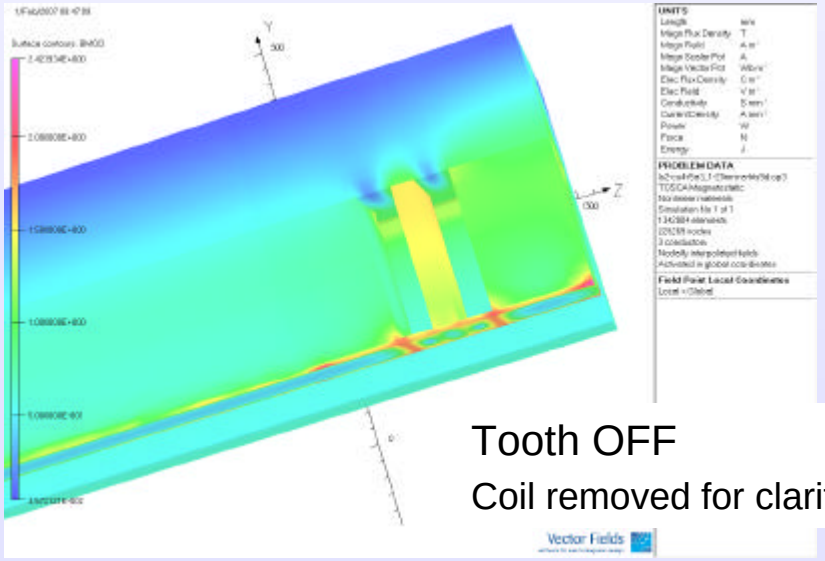


Tooth ON

Coil removed for clarity



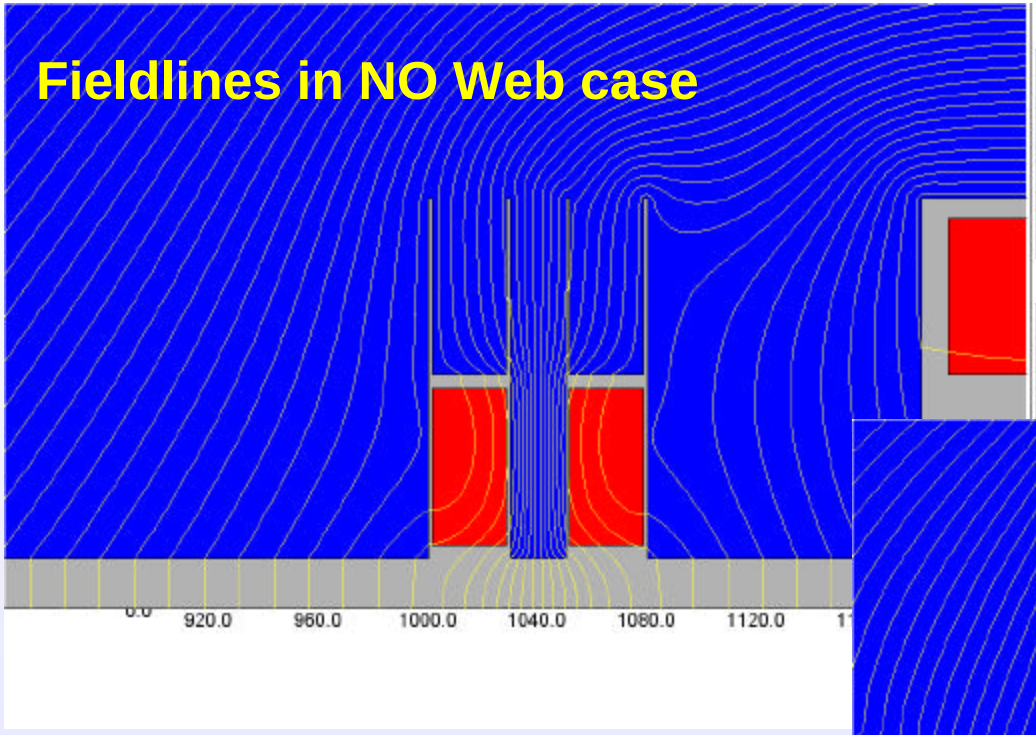
Tooth OFF

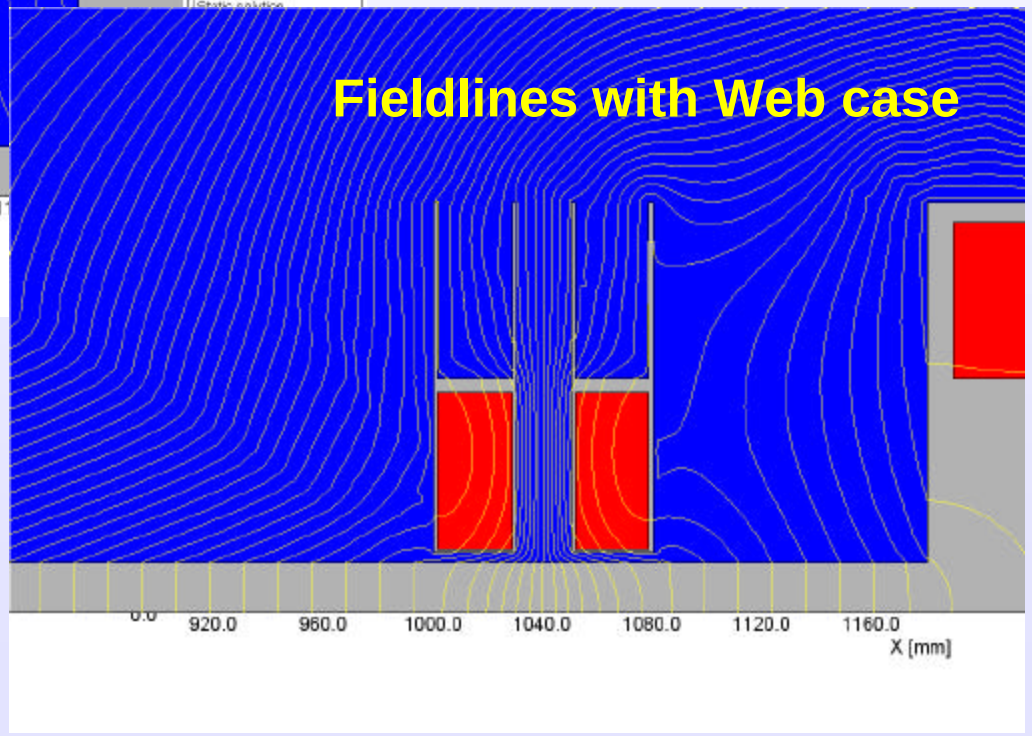


Tooth OFF

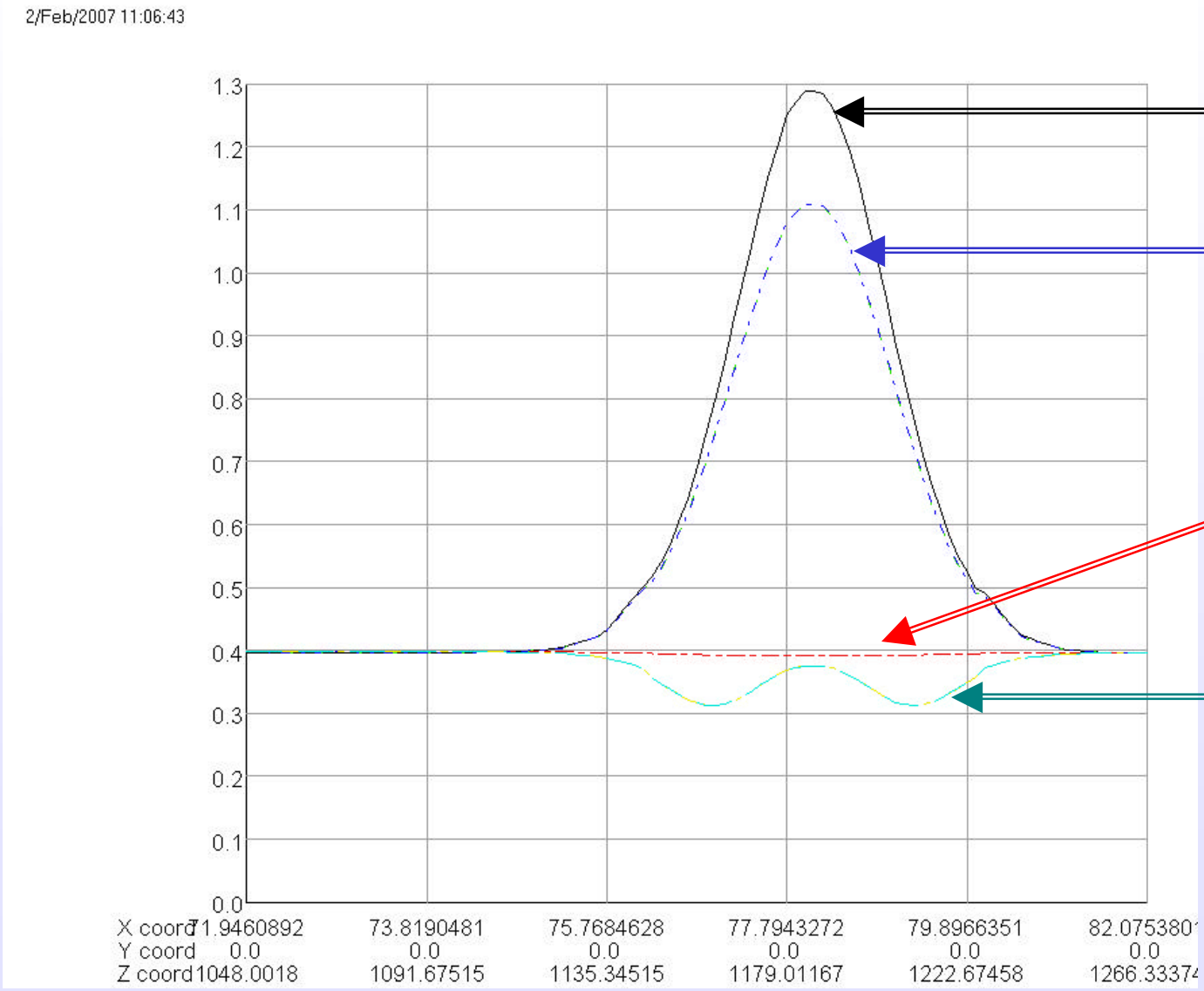
Coil removed for clarity

Fieldlines in HTS Tooth Region (With and Witout Web cases)





Magnetic Tooth Runs



Harmonics

Field Harmonic calculations include some computational errors

onics due to Tooth at 10 mm reference radius

n the fourier analysis of By

m 2.5 degree to 3 degrees from the center of the magnet

onics have been subtracted out

ic is name n=1)

n	Bn(T.m)
1	0.03454
2	-7.67E-06
3	3.32E-05
4	1.52E-05
5	-2.88E-05
6	1.99E-05
7	1.04E-05
8	5.94E-06
9	4.26E-05

Details of the Tooth

- Tooth is made of 2nd Generation HTS
- It is cooled by Liquid Nitrogen (or sub-cool nitrogen to reduce cost)
- It sits in a small box (all dimension ~5 inches or less)
- Cryo-box is a simple box with simple feed of coolant
- Very low nitrogen uses because of small dimension
- The conductor cost is expected to be ~10k$ (present cost higher because the conductor has just become available, < year)
- One can also consider, nitrogen cooled normal conductors as a variation or as an intermediate solution. They will have operating cost a little higher. But for small device like this, it is not an issue. Every thing developed here is interchangeable.

R&D Program Plan

To develop and demonstrate this concept

- We need a flexible and low cost R&D plan (NO expensive production engineering)
- It's a small table top device (all dimensions less than five inches)
- There are many exciting variations and possibilities
- The application of this concept can be used a number of NSLS2 devices (wavelength shifter, wiggler, undulator, etc.)
- A good example of things developed with a new project - similar to the number of new designs and techniques developed during RHIC and that are now being used worldwide